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Media uses and social representations of climate change

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Abstract

A survey study with Portuguese participants (N=614) was carried out to investigate the relationship between practices of media consumption, the use of other sources of information, and social representations of climate change.

Results show a moderate level of knowledge about climate change, a high level of concern and a high level of perceived risk towards the potential effects of climate change, emotionally negative images associated with climate change, and low frequency of climate-friendly individual behaviour. News media are reported to be the main sources of information on climate change and are positively assessed in terms of credibility.

Practices of media consumption are a predictor variable of individual mitigation actions, behavioural intentions, concern about climate change and, in a smaller degree, knowledge about climate change. However, they have little impact on risk perceptions and on the emotional valence of the images associated with climate change.

Keywords: climate change, media, social representations, attitudes, risk

1. Introduction

Research on the relationship between mediated messages and social representations and behaviours points to many interconnected factors and a complex network of influences. Several studies have suggested that the media play an important role in heightening awareness and concern in relation to climate change with impact on behaviours being relatively unclear (Krosnick, Holbrook & Visser, 2000; Mazur & Lee, 1993). While citizens' knowledge of climate change has been the focus of various studies (Bord, Fisher, & O'Connor, 1998; Brechin, 2003; Dunlap, 1998; Stamm, Clark & Eblacas, 2000), including the relationship with media content (Bell, 1994; Corbett & Durfee, 2004), attention has also been directed in the last few years towards affective factors in people's understanding of the issue (Leiserowitz, 2005; Lorenzoni et al., 2006) and towards behaviour and behavioural intentions (e.g. Nave & Schmidt, 2002).

This paper reports on work carried out within the framework of social representations (e.g. Bauer & Gaskell, 1999; Jovchelovitch, 1996; Moscovici, 1961). Research findings regarding

cognitive, affective and behavioural dimensions associated with climate change (i.e. knowledge, concern and risk perception, actions and behavioural intentions) are here interpreted in that theoretical context. Social representation theory aims at understanding common knowledge, which is grounded in language and in daily life, and at explaining how scientific concepts are integrated into everyday thinking and action (Moscovici, 1984). Social representations are 'a set of concepts, statements and explanations originating in daily life in the course of inter-individual communications' (Moscovici, 1981: 181) and are influenced by both informal communication and the media. They integrate cognitions, affects and actions (Jovchelovitch, 1996). Similarly to the concept of attitudes, they comprise cognitive and affective dimensions, as well as behavioural intentions. The main distinction is that attitudes are generally conceptualized as an 'individual' state, even if influenced by the social environment, while processes of social construction and social sharing are central in social representations.

Several multi-nation studies have demonstrated that lay people's knowledge of the causes of climate change is low (e.g. Brechin, 2003; Dunlap, 1998), and that people seem to have a broader representation of environmental issues that does not distinguish accurately the factors involved in different problems. For instance, people often mention air pollution as a cause of climate change or global warming, and often confuse ozone depletion with climate change (Bord et al., 1998; Brechin, 2003; Dunlap, 1998; Stamm et al., 2000).

Concern with climate change is not as high as concern with other environmental problems, such as air and water pollution (e.g. Brechin, 2003). It has been shown that concern depends on weather conditions (people show more concern under bad weather conditions; Ungar, 1992) and increases with extended media coverage (Krosnick, Holbrook & Visser, 2000). People associate climate change with a moderate to high risk, but these risks tend not to be perceived as a personal threat (e.g. Lorenzoni, Nicholson-Cole & Whitmarsh, 2007). They are seen as stronger in distant places and in the future rather than in the spatial and temporal proximity of the respondent (Leiserowitz, 2005), or, in the case of a Portuguese sample (Cabecinhas, Lázaro & Carvalho, 2006), as strong both in distant places (hurricanes, tsunami) and locally (draughts, fires). Affective imagery associated with climate change is mostly negative and is dominated by melting ice caps, rising temperatures, destruction and diseases (Cabecinhas et al., 2006; Lorenzoni et al., 2006).

Regarding willingness to take individual action, people accept undertaking some effort to mitigate emissions (e.g. acquiring domestic appliances and cars that are more energy-efficient) but do not generally support policies that interfere greatly with the convenience of their daily life (e.g. using the car less, carpooling, decreasing the use of heating and air-conditioning; Bord et al. 1998; Nave & Schmidt, 2002).

Research has shown that cognitive dimensions (knowledge on climate change), emotional dimensions (affective dimensions such as concern, risk perceptions and mental imagery), and

behavioural dimensions (such as behavioural intentions and reported behaviour in the mitigation of climate change) are not coherently related. This has been termed as the value-action gap or the attitude-behaviour gap (e.g. Blake, 1999; Bord et al., 1998; Lorenzoni et al., 2007). For instance, Nave and Schmidt (2002) found out that people viewed climate change as a worrying problem and agreed that a solution was needed, but did not report using the car less and failed to recognize the importance of causes such as the use of fossil fuels and consumption of electricity.

Despite the fact that the media are considered a key source of information for the public about science issues (e.g. Nelkin, 1987), very little research has been done on the influence of media coverage of climate change on audience perceptions, attitudes and behaviours. Scholars in the USA have shown that people build meaning about unobtrusive environmental issues, such as climate change, mainly through the media (Wilson, 1995; Corbett & Durfee, 2004).

In this paper we report results from a survey study with a Portuguese sample conducted in 2007. The study investigated the relationship between patterns of media consumption and social representations of climate change and was based on the following research questions: How do practices of media consumption relate to perceptions of risk and responsibility and to attitudes towards climate change? What is the emotional valence of images spontaneously associated with climate change? What is the relationship between cognitive, affective and behavioural dimensions towards climate change? What are the predictor variables of climate-friendly attitudes and behaviours?

We report findings on media consumption and its effects on cognitive, affective and behavioural dimensions of social representations of climate change. The cognitive dimension was defined as the knowledge level about the causes of climate change; the affective dimension comprised concern about climate change, risks perceptions and mental imagery; the behavioural dimension addressed reported individual behaviour and individual behavioural intentions.

We expect the media to be the main source of information about climate change and patterns of media consumption to affect the level of knowledge about the causes of climate change and the affective involvement with climate change. We expect to find a gap between respondents' representations of climate change and their actions (intended or reported).

Socio-demographic variables such as sex, education, age and place of residence have not been shown to affect systematically lay representations of climate change (e.g. Dunlap, 1998). Accordingly, we do not expect our results to be significantly affected by those variables.

2. Method

Participants: 614 Portuguese people (308 women and 306 men); mean age = 30.59 ($SD = 12.99$; range 18-75 years); 237 living in rural areas and 377 in urban areas; with diverse levels of education, areas of professional activity and professional situations.

Materials: Questionnaire covering the dimensions analyzed in this paper – degree and patterns of media usage; attitudes towards information sources; knowledge of climate change, concern, risk perceptions, behavioural intentions and environment-friendly practices, and perceived barriers to perform them – as well as other dimensions, such as attributions of responsibility and perceptions of relative justice.

Procedure of data collection: The questionnaire was administered in March 2007 in the northern part of Portugal. Participation was voluntary. Response times ranged from 25 to 40 minutes.

Procedure of data treatment: after an exploratory descriptive analysis of the data, we performed a factor analysis to group the participants according to their patterns of media consumption.

The impact of patterns of media consumption and socio-demographic variables on social representations of climate change was analyzed by two MANCOVAs. For the first MANCOVA, the dependent variables were the following: a knowledge index of causes of climate change; risk perceptions and level of concern about climate change; and emotional valence of the images associated with climate change. For the second MANCOVA, the dependent variables were reported actions of mitigation of climate change and behavioural intentions. After exploring correlations between variables, we also conducted a series of Multiple Linear Regression Analyses (MLRA; stepwise method), in order to find the predictors for each of the dependent variables mentioned above.

3. Results

3.1. Degree and patterns of media use

Respondents were asked to rate how often they gathered information on climate change from different sources (5-point scale ranging from 1='very often' to 5='never'). As expected, the media topped the information sources on climate change (see table 1). Overall, the most used source was television news. Respondents reported to use it frequently and significantly more often than the other sources. The second most used sources of information were newspapers, followed by televised films and documentaries. The least used sources of information were books, publications and leaflets, and events (such as conferences and exhibitions).

Table 1. Use of sources of information on climate change

Sources of information	Mean (SD)	Factor 1	Factor 2
TV news	1.81 (1.81)		.810
Newspapers (printed or online)	2.29 (1.14)		.684
TV films and documentaries	2.57 (1.15)		.530
Family, neighbours, friends or colleagues	2.71 (1.06)		
Internet (excluding sites of newspapers, radios and TVs)	2.89 (1.36)	.772	
Magazines	2.89 (1.10)		
Radio	3.01 (1.14)		.645
School or university	3.36 (1.40)	.774	
Books	3.40 (1.10)	.680	
Publications or leaflets	3.41 (1.08)		
Events (conferences, exhibitions, etc.)	3.97 (1.05)	.701	
% of variance explained		38.15	12.72

Note: Mean ratings are based on a 5-point scale (1= very often, 5 = never); Factor Analysis: K-M-O measure of sampling adequacy = .818; Bartlett's test – Chi-Square = 1457.95; $p < .001$

Sources of information were divided into two factors obtained by an exploratory Factor Analysis (method varimax): 'more actively sought' sources of information (internet; school or university; books; and events) and 'mass media' (TV news; Newspapers; Radio; TV films and documentaries) – factors 1 and 2 in table 1 respectively. Together these factors explained 50.87 of the total variance (see table 1). Items with loadings lower than 0.5 were excluded from the factor. For each factor, respondents were divided according to the reported degree of use of sources of information on that factor: *heavy users* (above the median) and *occasional users* (below the median). For factor 1 the median was 3.50 and for factor 2 the median was 2.25. This distinction was used in other analyses.

3.2. Perception of sources of information on climate change

Participants were asked to rate the trustworthiness of sources of information about climate change in a 5-point scale ranging from 1='trust very much' to 5='do not trust at all' (see table 2). Overall, respondents expressed a high degree of trust in information coming from scientists and experts, followed by information from health professionals, environmental or consumer associations, the European Union and teachers. Respondents had some trust in media sources and people they know (family, friends, neighbours and colleagues), and expressed mistrust in information coming from sources such as government, local authorities and corporations.

Table 2. Trust in sources of information on climate change and assessment of their coverage of climate change

Trust in sources of information on climate change (5-point scale: 1= trust very much, 5 = do not trust at all)	Mean (SD)
Scientists/experts	1.46 (0.64)
Health professionals/doctors	1.77 (0.73)
Environmental/consumer associations	1.89 (0.73)
European Union	2.01 (0.77)
Teachers	2.01 (0.71)
Newspapers	2.05 (0.71)
Television	2.12 (0.72)
Radio	2.16 (0.69)
Journalists	2.17 (0.71)
Internet (excluding sites of newspapers, radios and TVs)	2.25 (0.71)
Family, friends, neighbours or colleagues	2.37 (0.70)
Government	2.67 (0.77)
Local authorities	2.72 (0.72)
Corporations	2.74 (0.78)
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Assessment of the most used mass medium (5-point scale : 1= very good, 5 = very bad)	
Clarity of explanations of climate change	1.90 (0.70)
Accuracy of scientific and technological information on climate change	2.05 (0.73)
Analysis of policy and economic options to fight climate change	2.22 (0.73)

Globally, this pattern of results is in accordance with studies conducted before, both in Portugal (e.g. Lázaro, Cabecinhas & Carvalho, 2007) and in other countries. For example, a widespread mistrust in government, politicians and corporations has been found on studies conducted in the UK (e.g. Blake, 2001; Lorenzoni et al., 2007). In contrast, scientists, university and social networks are among the most trusted sources of information.

Participants were asked to indicate the medium they used most frequently as a source of information on climate change. The answers were, in order of importance: TV channels (76,4% overall; public service TV channels RTP 1 and RTP 2 - 52,1%; commercial channels SIC or TVI - 24,3%), newspapers (18%) and radio stations (2,2%). As the majority of the participants mentioned a TV channel we divided participants into three groups according to their choices: users of a public service TV channel; users of a commercial TV channel; and users of TV as a secondary mass medium. These categories were used in further analyses.

Participants were also asked to rate the medium they used most frequently in a 5-point scale ranging from 1='very good' to 5='very bad' regarding clarity of explanation of the climate change issue; accuracy of scientific and technological information; and quality of analysis of policy and economic options to fight climate change. Overall, the medium that was most used by each respondent was assessed as providing clear explanations of climate change, and accurate scientific and technological information (see table 2). The analysis of policy and economic options to fight climate change was seen as good. The level of alarmism in the news about climate change was rated in a 3-point scale ranging from 1='excessive' to 3='insufficient'. Overall, participants rated it as moderate ($M = 2.01$, $SD = 0.47$).

These results appear excessively positive in comparison to other studies (e.g. Lorenzoni et al., 2007) and might be partially explained by the fact that the survey was presented to respondents as linked to the Department of Communication Sciences of a well-known university in Portugal. This could have elicited a social desirability bias and produced less critical answers towards the media.

3.3. Knowledge of causes of climate change

Respondents were presented with six items and asked to say whether each of them was a contributing factor to climate change (see table 3). We computed a knowledge index by adding one point for each correct answer and dividing it by the number of items. The index ranged from 0 to 1. Results point to an overall moderate knowledge of the causes of climate change ($M = 0.67$; $SD = 0.17$), which is apparently better than the low level reported by previous studies (e.g. Brechin, 2003; Dunlap, 1998). However, the dichotomous scale that we used meant that the chance of choosing the right option was 50%.

Despite this moderate level of knowledge, people continue to show some confusion in relation to the causes of climate change, namely concerning the role of the ozone hole. In fact, only 5,7% of the participants gave the right answer concerning the item 'ozone hole'. The depletion of the ozone layer, which is a quite distinct problem from climate change and which experts do not consider as a cause of the latter, was the item that received the highest percentage of answers as a contributing factor to climate change (94,3%). This is a finding commonly reported in the literature (Bord et al., 1998; Brechin, 2003; Lázaro et al., 2007; Dunlap, 1998; Stamm et al., 2000).

Industrial processes (93.6%) and car use (93.6%) were correctly indicated as contributing to climate change. The loss of rain forests, car use, and the functioning of coal and oil power plants, which are also causes identified by experts, were considered contributors to climate change by participants in this study as well. However, 56% of participants considered that agriculture and animal husbandry do not contribute to climate change, when in fact they are

significant causes of greenhouse gas emissions. Overall, agriculture and animal husbandry was seen as the item with the lowest contribution to climate change (44.4%).

By emphasizing industrial processes and car use, these results seem to reflect a better understanding of the causes of climate change than the results from the Portuguese sample of the 1992 Gallup survey (Dunlap, 1998) – by then the major causes of global warming that were chosen by respondents were loss of rain forests (89%), nuclear power plants (85%), coal and oil power plants (83%), automobile exhaust (77%), aerosol sprays (67%), and refrigerators and air conditioners (45%). However, it must be noted that the questions posed in each of the questionnaires were slightly different.

Table 3. Knowledge of the causes of climate change

Percentage of respondents considering that this factor contributes to climate change	%
Ozone hole	94.3
Industry	93.6
Car use	93.6
Loss of forests	86.9
Functioning of coal and oil power plants	82.6
Agriculture and animal husbandry	44.4

3.4. Risk perceptions, emotional reaction and concern with climate change

General risk perceptions and emotional reaction to climate change

Respondents rated the likelihood of being personally affected by a set of factors, including climate change, using a 5-point scale ranging from 1='very likely' to 5='unlikely' (see table 4).

Table 4. Mean risk perception

Situation	Mean (SD)
Pollution	2.19 (0.94)
Climate change	2.22 (0.94)
Car accident	2.24 (0.97)
Cancer	2.48 (1.00)
Unemployment	2.50 (1.19)
Violent crime	2.88 (1.05)
Terrorism	3.34 (1.04)
HIV infection	3.37 (1.23)
Earthquake	3.38 (1.06)

Note: 5-point scale (1= very likely, 5 = unlikely)

Respondents considered that is likely that they will be affected by 'pollution', 'climate change' and will suffer a car accident (these mean values did not differ significantly). The likelihood of being affected by other factors was considered lower. These results show that Portuguese citizens consider climate change a serious personal threat and contrast with conclusions of earlier studies in other countries (e.g. Lorenzoni, Nicholson-Cole & Whitmarsh, 2007). The significant increase in the visibility of climate change in the media that took place in 2007 may contribute to explaining such a difference.

Participants were asked to freely associate words with 'climate change' and to rate the emotional valence of those words using a 5-point scale ranging from 1='very positive' to 5='very negative'. The emotional valence of the images associated with climate change was very negative ($M = 4.45$, $SD = 0.79$), which is enhanced by the feeling of vulnerability reported in the previous question. This result supports the view that participants see themselves as potential victims of climate change, as found in a previous study (Cabecinhas et al., 2006).

Concern with climate change

Respondents were asked how concerned they were with a set of environmental issues, including climate change, and answered in a 5-point scale ranging from 1='very much worried' to 5='not worried at all' (see table 5).

Table 5. Mean concern with environmental issues

	Mean (SD)
Forest fires	1.74 (0.75)
Air pollution	1.75 (0.79)
Decrease of forests	1.82 (0.81)
Ozone hole	2.05 (0.84)
Climate change	2.05 (0.83)
Lack of green spaces	2.35 (1.03)
Use of genetically modified organisms	2.69 (0.99)

Note: 5-point scale (1= very much worried, 5 = not worried at all)

Respondents reported a high level of concern with climate change and said they were very or moderately concerned with all the other issues presented to them. The exception was genetically modified organisms for which concern was situated at the middle of the scale. Participants showed a high level of concern with forest fires, air pollution and decrease of forests. Levels of concern with the ozone hole and climate change were exactly the same.

Perceptions of risk associated with the impacts of climate change

Respondents rated a set of possible consequences of climate change according to the level of perceived risk (5-point scale ranging from 1='very serious' to 5='not serious'; see table 6). All the possible consequences were viewed as very serious or as moderately serious. Draughts and health problems were the consequences rated as most serious; 'increased inequity between rich and poor countries' and 'increased forced migrations' were rated as least seriously.

Table 6. Mean risk perceptions for possible impacts of climate change

	Mean (SD)
Draughts	1.40 (0.66)
Health problems	1.42 (0.68)
Increase of hunger in the world	1.52 (0.87)
Flooding	1.54 (0.73)
Loss of animal and vegetable species	1.56 (0.81)
Sea-level rise	1.56 (0.83)
Hurricanes and storms	1.64 (0.77)
Desertification	1.66 (0.82)
Heat waves	1.73 (0.72)
Cold waves	1.73 (0.81)
Changes in agricultural production	1.99 (0.83)
Increased inequity between rich and poor countries	2.00 (1.01)
Increase of forced migrations	2.10 (0.94)

Note: 5-point scale (1= very serious, 5 = not serious)

3.5. Reported behaviours, intentions and barriers to action

Reported pro-environmental behaviours

Respondents rated the frequency of their pro-environmental behaviours in a 5-point scale ranging from 1='very often' to 5='never'. The most frequent reported actions were using less heating and air-conditioning ($M = 2.39$, $SD = 1.23$), and the separation of waste for recycling ($M = 2.53$, $SD = 1.30$). Saving energy at home is an appropriate behaviour to combat climate change so this is a positive finding, even if heating and air-conditioning are less needed in the Portuguese climate than in other countries; recycling is arguably more effective for other environmental issues than climate change. Respondents reported to make a rare use of public transport ($M = 3.07$, $SD = 1.36$). The results converge partially with the literature – recycling and energy conservation at home are the most frequent actions that people are willing to undertake (as summarized by Lorenzoni et al., 2007).

Behavioural intentions to fight climate change

Respondents were also asked to report the actions of mitigation of climate change that they had already undertaken or would be willing to adopt, using the following scale: 1 = already did, 2 = planning to do in the short-term, 3 = planning to do in the long-term, 4 = not planning to do; 9 = does not apply to my situation (see table 7). To replace conventional light bulbs with low-consumption bulbs is a mitigation action that most participants had already undertaken or intended to do in the short-term. Most participants also reported that they were planning to acquire more energy-efficient domestic appliances in the short-term. The installation of solar panels was a mitigation action that participants typically planned to undertake in the long term or did not plan to undertake at all. In sum, participants had already undertaken or were planning to pursue in the short-term actions that involved little financial investment; actions that involved more financial cost, like improving a house from an environmental point of view, were not planned for the near future or were not planned at all.

Table 7. Behavioural intentions towards actions of mitigation of climate change

	Mean (SD)
Replace conventional light bulbs with low-consumption bulbs	1.62 (0.93)
Acquire more energy-efficient domestic appliances	2.23 (1.07)
Take environmental aspects into account when acquiring high-budget items (e.g. a car, a house)	2.53 (1.02)
Improve insulation of home walls and roof	2.59 (1.11)
Install solar panels	3.23 (0.23)

Note: 4-point scale (1 = already did, 2 = planning to do in the short-term, 3 = planning to do in the long-term, 4 = not planning to do; 9 = does not apply to my situation)

Perceived barriers to engaging in mitigation actions

Respondents were asked to report why they did not do more to fight climate change by choosing any number of response options. Financial cost was the most chosen option (40.1% of respondents). Lack of information (32.4%) and lack of time (29.2) were also considered important barriers. Only 3.9% of the respondents mentioned that they did not do more because they were not worried with this issue; 16.6% did not believe that they could solve the problem; and 14.3% considered themselves too lazy to do more to fight climate change.

This pattern of results is consistent with the high level of concern about climate change reported in table 4, but also indicates that participants feel helpless and that they are not sufficiently informed about mitigation actions. The way the media have been reporting on climate change in Portugal may play a role here as useful practical information for reducing greenhouse gas emissions has rarely been made available. The internet obviously offers a wide

variety of approaches and depictions of climate change but the analysis of Portuguese websites suggests that the dominant discourse is a techno-managerial one with the emphasis on national and international regulatory mechanisms (Carvalho, 2007).

3.6. Effects of the use of information sources

Effect of the use of information sources on knowledge, concern, risk perception and affective imagery associated with climate change

We used a MANCOVA to analyse the effects of the use of information sources and socio-demographic variables on the cognitive and affective dimensions of social representations of climate change. Four factors were used: 'mass media' and 'more actively sought' sources of information (2 levels in each factor: high and low consumption of information), type of TV channel (3 levels: users of a public TV channel; users of a commercial TV channel; and users of TV as a secondary medium) and sex (2 levels: female and male). The covariate was the age of the participant.

The dependent variables were the knowledge index of causes of climate change, risk perception and level of concern about climate change, and emotional valence of the images associated with climate change.

We found that the type of use of information sources affected significantly the knowledge index ['more actively sought' sources: $F(4,533) = 3.37$, $p = .01$; type of TV channel: $F(8,1062) = 2.24$, $p = .01$]. *Heavy users* of 'more actively sought' sources (internet, school or university, books and events) showed a higher level of knowledge about the causes of climate change than *occasional users* [$F(1,533) = 6.57$, $p = .01$]. There was no significant difference amongst users of 'mass media' sources (newspapers, TV news, TV films and documentaries, and radio). Users of public service channels showed a higher level of knowledge than users of commercial channels [$F(2,533) = 3.58$, $p = .03$].

Patterns of use of information sources did not affect significantly the perceived likelihood of being affected by climate change and the emotional valence of the images associated with climate change.

The use of information sources affected significantly the level of concern with climate change. ['more actively sought' sources: $F(4,533) = 3.37$, $p = .01$, type of TV channel: $F(8,1062) = 2.24$, $p = .01$]. *Heavy users* of 'mass media' sources showed a higher level of concern about climate change than *occasional users* [$F(1,533) = 5.65$, $p = .02$]. Patterns of use of information sources did not significantly affect risk perceptions of the possible impacts of climate change.

The sex of participants had a significant effect on the combined dependent variables [$F(4,530) = 4.13$, $p = .01$]. Subsequent ANOVAs showed that women were more likely to consider that they could be affected by climate change [$F(1,533) = 3.78$, $p = .05$], were more concerned

[F (1,533) = 6.95, $p = .001$] and showed more negative affective images [F (1,533) = 8.34, $p = .004$] than men.

Interactions between variables did not produce a systematic pattern and therefore are not analyzed here.

As expected, we found that the type of use of information sources affected significantly the level of knowledge about the causes of climate change, with *heavy users* of 'more actively sought' sources showing more knowledge than *occasional users*, and users of public TV channels showing more knowledge than users of commercial TV channels.

Overall, the patterns of use of information sources did not affect the emotional aspects covered by our survey. These results contradict our expectations. The only exception was the level of concern with climate change: *heavy users* of 'mass media' sources showed a higher level of concern about climate change than *occasional users*.

Results might be explained by the very frequent media coverage of climate change in the Portuguese media in 2007, which may have produced a high perceived likelihood of being affected by climate change as well as motivated negative images even in occasional users.

Effect of the use of information sources on reported mitigating actions and behavioural intentions associated with climate change

This MANCOVA analysed the effects of the use of information sources and socio-demographic variables on the behavioural dimensions of social representations of climate change. It used the same factors and covariate of the previous analysis. The two dependent variables were mitigating actions and behavioural intentions associated with climate change, which were significantly affected by age [F(2,584) = 7.24, $p = .01$], 'more actively sought' sources of information [F(2,584) = 8.87, $p = .01$], 'mass media' sources [F(2,584) = 7.15, $p = .001$] and sex [F(2,584) = 3.42, $p = .03$]. Subsequent ANOVAs showed that: age significantly affects behavioural intentions [F(1,585) = 10.32, $p < .01$], which increase with increasing age ($\beta = -.007$, $t = -3.21$, $p < .01$); a higher consumption of 'more actively sought' sources of information increased the frequency of reported mitigating actions [F(1,585) = 13.76, $p < .01$] and behavioural intentions [F(1,585) = 7.84, $p = .005$]; a higher consumption of 'mass media' sources increased the frequency of reported mitigating actions [F(1,585) = 9.12, $p = .003$] and behavioural intentions [F(1,585) = 8.49, $p = .004$]. Sex did not produce a significant effect in a subsequent ANOVA.

The interaction between the use of 'mass media' sources and sex was significant [F(2,584) = 3.53, $p = .03$] and a subsequent ANOVA [F(1,585) = 6.33, $p = .01$] showed that reported mitigating actions are higher for women with high consumption of information than for men with high consumption of information.

3.7. Predictors of engagement with climate change

After exploring the correlations between variables, we conducted a series of Multiple Linear Regression Analyses (MLRA), stepwise method, in order to identify the predictors of each of the previously mentioned dependent variables (knowledge of causes of climate change, risk perception, level of concern about climate change, emotional valence of images associated with climate change, reported actions of mitigation of climate change, and behavioural intentions).

Knowledge about the causes of climate change was significantly predicted by two variables: level of schooling ($\beta = .121$, $p < .003$) and reported frequency of using 'more actively sought' sources of information about climate change ($\beta = -.091$, $p < .027$). These results show that knowledge about climate change increases with increasing level of schooling and *heavy users* of 'more actively sought' sources of information had higher knowledge than *occasional users*. However, the variance explained by this model is low (adjusted $R^2 = .027$).

Two predictor variables were found for the perceived likelihood of being affected by climate change: respondents' sex ($\beta = .115$, $p < .005$) and the reported frequency of using 'more actively sought' sources of information about climate change ($\beta = .087$, $p < .032$). These results show that women feel more vulnerable about climate change than men and that *heavy users* of 'more actively sought' sources feel less vulnerable than *occasional users*. The variance explained by this model is low (adjusted $R^2 = .022$).

Level of concern with climate change was significantly predicted by two variables: frequency of using 'more actively sought' sources of information ($\beta = .193$, $p < .001$) and frequency of using 'mass media' sources ($\beta = .142$, $p < .001$). *Heavy users* of [both types of] sources of information felt more concerned about climate change than *occasional users*. The variance explained by this model is low (adjusted $R^2 = .082$).

Three predictor variables were found for reported mitigation actions: frequency of using 'more actively sought' sources of information ($\beta = .194$, $p < .001$); frequency of using 'mass media' sources ($\beta = .129$, $p < .001$); and level of concern with climate change ($\beta = .170$, $p < .001$). *Heavy users* of sources of information reported higher frequency of mitigation actions than *occasional users*; and the higher the level of concern the higher the frequency of mitigation actions. The variance explained by this model is low but higher than for the previously mentioned models (adjusted $R^2 = .128$).

Four predictor variables were found for reported behavioural intentions: frequency of using 'more actively sought' sources of information ($\beta = .115$, $p < .010$); frequency of using 'mass media' sources ($\beta = .159$, $p < .001$); age ($\beta = -.188$, $p < .001$), and level of knowledge about climate change ($\beta = -.180$, $p < .001$). These results show that *heavy users* of sources of information reported intentions to undertake mitigation actions in a higher degree than

occasional users; and that behavioural intentions increased with increasing age and knowledge. The variance explained by this model is low (adjusted $R^2 = .099$).

Overall, socio-demographic variables had little impact on the results: sex affected only the affective dimensions, age affected the reported behavioural intentions and level of instruction affected the level of knowledge about climate change.

The degree and patterns of use of information sources revealed some significant impacts. Statistically significant correlations were found between practices of use of information sources and reported individual mitigation actions, as well as between use of information sources and behavioural intentions. Use of information sources was also associated with concern about climate change (the higher the reported frequency of use of information sources the higher the level of concern) and, on a smaller degree, with knowledge about climate change (the higher the reported frequency of use of information sources the higher the level of knowledge). However, practices of use of information sources appear to have little impact on risk perceptions and on the emotional valence of images associated with climate change.

However, the variance explained by the models is quite low, so we need to further explore the variables affecting levels of engagement with climate change.

4. Final remarks

As expected, social representations of climate change did not show a coherent pattern between knowledge, affective dimensions (concern, risk perception and affective images) and behavioural aspects, such as mitigating actions and behavioural intentions.

Our sample showed a moderate level of knowledge about the causes of climate change. Knowledge seems to be increasing slowly over the past 15 years – the Portuguese sample in the Gallup's 1992 survey showed a low level of knowledge (Dunlap, 1998). However, the majority of respondents did not recognize the contribution of agriculture and animal husbandry to climate change. Furthermore, there is still confusion about the role of the ozone hole, which respondents considered the main contributor to climate change. Recent studies conducted in other countries show that there is still a widespread association of the ozone hole with climate change (Kirby, 2003; Poortinga et al., 2006). This finding supports the view that people incorrectly relate climate change to other environmental issues, particularly stratospheric ozone depletion (Bostrom et al., 1994; Read et al., 1994) and that other dimensions (such as imagery) than knowledge are involved (Cabecinhas et al., 2006; Lorenzoni et al., 2006).

Knowledge of the causes of climate change was significantly affected by the patterns and degree of use of information sources: *heavy users* of 'more actively sought' sources revealed higher knowledge than *occasional users* and users of public service channels revealed higher knowledge than users of commercial channels.

Several affective dimensions were analyzed in this paper: general risk perceptions; concern with climate change; emotional valence of images freely associated with climate change; and risk perceptions about the possible impacts of climate change. Respondents rated the risk of being affected by pollution and by climate change as high in comparison with other risks. Respondents were very or moderately concerned with all the environmental issues presented to them. Concern with forest fires, air pollution and the decrease of forests was very high, followed closely by concern with the ozone hole and climate change. All the possible consequences of climate change were viewed as very serious or as moderately serious. Consequences on the 'physical' world (draughts, flooding) were rated as more serious than 'social' consequences ('increased inequity between rich and poor countries' and 'increased forced migrations'). The high levels of risk perception and concern with climate change were in accordance with the very negative emotional valence of the images spontaneously associated with the issue.

Emotional reaction to climate change was significantly affected by the sex of the respondents and, in some cases, by patterns and degree of use of information sources: women showed a higher level of risk perception, felt more concerned and evoked more negative images than men; users of public service channels revealed higher concern than users of commercial channels; *heavy users* of information sources revealed higher concern than *occasional users* (for both types of sources). This result does not allow us to conclude that a higher use of information sources causes more concern as it may instead be concern that motivates the search for information, which may in turn reinforce concern. Further research on the motives for media consumption for environmental issues, particularly climate change, should address the relationship between motives and types of consumption and the way they reinforce each other.

The level of behavioural intentions to fight climate change was relatively high. These results may be due to social desirability, but they suggest that people are aware that they can contribute to mitigating climate change through their individual behaviours.

Behavioural tendencies were significantly affected by patterns and degree of use of information sources: *heavy users* reported higher levels of actions and more behavioural intentions than *occasional users* (for both types of sources); users of public service channels reported higher levels of actions and more behavioural intentions than users of commercial channels. The reasoning presented above about levels of concern also applies here: uses of information sources and behavioural trends may have a circular cause-effect relationship.

Overall, there is a gap between the high level of concern, risk perception and affective imagery associated with climate change, on the one hand, and the frequency of mitigating actions, on the other hand. The perceived likelihood of being affected by climate change and levels of concern with the issue were very high (they increased considerably when comparing to an exploratory study conducted in 2006; Lázaro et al., 2007). Studies in other countries also found an increase in concern with climate change, particularly since 2003 (GlobeScan, 2006;

cited by Lorenzoni et al., 2007). However, reported actions and intentions are still lower than expected for such high levels of concern and moderate-high level of knowledge of the causes. Our findings are consistent with the widely reported 'value-action' or 'attitude-behaviour' gap (e.g. Blake, 1999; Kollmuss & Agyeman, 2002).

Responses to our survey also pointed to an inconsistency between behaviour and knowledge levels. We found that increasing knowledge of the causes of climate change led to greater behavioural intentions, but it did not affect both the actual mitigation actions reported, or concern with climate change. This is a point that requires further exploration as new data becomes available. Conceptually, we can be highly concerned about an issue as long as we are aware of it and regardless of the level of knowledge. However, to act adequately to address climate change requires knowledge of the correct mitigating behaviours.

Confronted with the question of why respondents did not fight climate change, they mentioned mainly individual barriers: financial cost involved, lack of information and lack of time. Other individual barriers have been suggested by research: lack of knowledge; uncertainty and scepticism; mistrust in information sources; externalising responsibility and blame; reliance on technology; climate change perceived as a distant threat; importance of other priorities; reluctance to change lifestyles; fatalism; and helplessness; together with social barriers such as lack of action by governments, business and industry; 'free rider effect'; pressure of social norms and expectations; and lack of enabling initiatives (Lorenzoni et al., 2007).

In conclusion, the media are the main source of information about climate change and practices of use of information sources have a significant impact on some dimensions of personal engagement with the issue – concern and, in a lesser degree, knowledge about climate change, as well as mitigating actions and behavioural intentions. However, the degree of use of information sources seems to have little impact on risk perceptions and on the emotional valence of images associated with climate change.

Further theoretical developments should focus on social factors. Social identity has been shown to be an important influence on people's pro-environmental behaviours (summarized by Lorenzoni et al., 2007) and literature on social representations emphasizes the role of interpersonal communication in the construction of a shared reality. Social representations are not simply given by the media or other sources of information. They are created and re-created in everyday social interaction (Moscovici, 1981). Analyzing social networks and social identity is a promising venue to understand lay people's engagement with climate change.

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References

- Bauer, M. W. and Gaskell, G. (1999) 'Towards a Paradigm for Research on Social Representations', *Journal of the Theory of Social Behaviour* 29 (2): 163-86.
- Bell, A. (1994) 'Media (Mis)communication on the Science of Climate Change', *Public Understanding of Science* 3 (4): 259-75.
- Blake, D. E. (2001) 'Contextual Effects on Environmental Attitudes and Behaviour', *Environment and Behaviour* 33: 708-25.
- Blake, J. (1999) 'Overcoming the 'Value-action Gap' in Environmental Policy: Tensions between National Policy and Local Experience', *Local Environment* 4 (3): 257-78.
- Bord, R. J., Fisher, A., and O'Connor, R. E. (1998) 'Public Perceptions of Global Warming: United States and International Perspectives', *Climate Research* 11: 75-84.
- Bostrom, A., Morgan, M.G., Fischhoff, B. and Read, D. (1994) 'What do People know about Global Climate Change? 1. Mental Models', *Risk Analysis* 14: 959-70.
- Brechin, S. R. (2003) 'Comparative Public Opinion and Knowledge on Global Climatic Change and the Kyoto Protocol: the U.S. versus the World?', *International Journal of Sociology and Social Policy* 23 (10): 106-34.
- Cabecinhas, R., Lázaro, A. and Carvalho, A. (2006) 'Lay Representations on Climate Change', in *Proceedings of IAMCR's 25th Conference*: 504-508. S.I.: IAMCR.
[<http://hdl.handle.net/1822/5335>]
- Carvalho, A. (2007) 'As Alterações Climáticas no Ciberespaço Português: Mediações dos Saberes e dos poderes' [Climate Change in the Portuguese Cyberspace: Mediations of Knowledges and Powers], *Revista de Comunicação e Linguagens* 38: 253-63.
- Corbett, J. and Durfee, J. (2004) 'Testing Public (Un)certainly of Science: Media Representations of Global warming', *Science Communication* 26 (2): 129-51.
- Dunlap, R. E. (1998) 'Lay Perceptions of Global Risk – Public Views of Global Warming in Cross-national context', *International Sociology* 13 (4): 473-98.
- Jovchelovitch, S. (1996) 'In Defense of Representation', *Journal of the Theory of Social Behaviour* 26: 121-36.
- Kirby, D. A. (2003). 'Scientists on the Set: Science Consultants and the Communication of Science in Visual fiction', *Public Understanding of Science* 12: 261-78.
- Kollmuss, A. and Agyeman, J. (2002) 'Mind the Gap: Why do People Act Environmentally and what are the Barriers to Pro-environmental Behavior', *Environmental Education Research* 8: 239-60.

- Krosnick, J. A., Holbrook, A. L. and Visser, P. S. (2000) 'The Impact of the Fall 1997 Debate about Global Warming on American Public Opinion', *Public Understanding of Science* 9: 239-60.
- Lázaro, A., Cabecinhas, R. and Carvalho, A. (2008) 'Perceptions of Climate Change Risks and Mitigation Behaviors: Understanding Inconsistencies between Representations and Actions', in B. Willard & C. Green (eds.) *Communication at the Intersection of Nature and Culture, Proceedings of the Ninth Biennial Conference on Communication and the Environment*: 264-75. Chicago: DePaul University. [<http://www.esf.edu/ecn/coce2007prc.htm>]
- Leiserowitz, A. A. (2005) 'American Risk Perceptions: Is Climate Change Dangerous?,' *Risk Analysis* 25 (6): 1433-42.
- Lorenzoni, I., Leiserowitz, A., Doria, M. F., Poortinga, W. and Pidgeon, N. (2006) 'Cross-national Comparisons of Image Associations with 'Global Warming' and 'Climate Change' among Laypeople in the United States of America and Great Britain', *Journal of Risk Research* 9 (3): 265-81.
- Lorenzoni, I., Nicholson-Cole, S. and Whitmarsh, L. (2007) 'Barriers Perceived to Engaging with Climate Change among the UK Public and their Policy Implications', *Global Environmental Change* 17: 445-59.
- Mazur, A. and Lee, J. (1993) 'Sounding the Global Alarm: Environmental Issues in the US national News', *Social Studies of Science* 23: 681-720.
- Moscovici, S. (1961) *La Psychanalyse, son Image et son Public*. Paris: PUF.
- Moscovici, S. (1981) 'On Social Representations', in J. P. Forgas (ed.) *Social Cognition - Perspectives on Everyday understanding*: 181-209. London: Academic Press.
- Moscovici, S. (1984) 'The Phenomenon of Social Representations', in R. Farr and S. Moscovici (eds.) *Social Representations*: 3-69. Cambridge: Cambridge University Press.
- Nave, J. G. and Schmidt, L. (2002) *As Alterações Climáticas no Quotidiano: Estudo Comportamental de Curta duração. Relatório Final* [Climate Change in Daily Life: Short-duration Study of Behaviours. Final Report]. Lisbon: ISCTE.
- Nelkin, D. (1987) *Selling Science. How the Press Covers Science and Technology*. New York: W. H. Freeman.
- Read, D., Bostrom, A., Morgan, M.G., Fischhoff, B. and Smuts, T. (1994) 'What do People Know about Global Climate Change? 2. Survey Studies of Educated Laypeople,' *Risk Analysis* 14: 971-82.
- Stamm, K. R., Clark, F. and Eblacas, P. R. (2000) 'Mass Communication and Public Understanding of Environmental Problems: The Case of Global Warming,' *Public Understanding of Science* 9: 219-37.

Ungar, S. (1992) 'The Rise and (Relative) Decline of Global Warming as a Social Problem', *Sociological Quarterly* 33 (4): 483–501.

Wilson, K. (1995) 'Mass Media as Sources of Global Warming Knowledge,' *Mass Communication Review* 22 (1-2): 75-89.

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